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ABSTRACT

A number of issues involved in the large-scale assessment of science and mathematics education were illustrated during the conduct of two national surveys: the 1977 National Survey of Science, Mathematics, and Social Studies Education and the 1985 National Survey, Science and Mathematics Education. Development of the survey questionnaires started with a series of questions from the sponsoring agency. However, explicit indicators of quality in science and mathematics education were not available; thus, the advisory committee developing the questionnaire had many debates over data collection needs. One fortunate decision of the 1977 study was to study the textbooks used. An unfortunate decision was to omit course enrollment statistics for different races and genders; this would have proved useful. The 1985 survey focused on getting information from principals and from teachers, since those respondents previously provided the most heavily used data. Acquiring approval for data collection was often a lengthy process. The 1985 survey emphasized teacher certification and subject matter qualifications. These items were difficult to analyze and still require further study. The 55-item 1985 Teacher Questionnaire and the 28-item 1985 Principal Questionnaire are appended. (GDC)

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DEVELOPING INDICATORS OF SCIENCE AND MATHEMATICS EDUCATION: INSIGHTS FROM TWO NATIONAL SURVEYS

Dr. Iris R. Weiss

Prepared for the Symposium on Indicators of Science and Mathematics Education in U.S. Elementary and Secondary Schools

Presented at the Annual Meeting
of the American Educational Research Association

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In recent years there has been a great deal of interest in assessing the condition of pre-college science and mathematics education in the United States. The Research Triangle Institute has been involved in two major surveys of science and mathematics education, one conducted in 1977 and the other just recently completed. This paper describes the relationship between the types of data collected in these two national surveys and the current efforts to develop a set of key indicators of science and mathematics education. Some of the practical problems associated with collecting indicator data are also discussed.

Having directed two national surveys of science and mathematics education in the last 10 years, I can attest to the need to develop a set of indicators of pre-college education in these subjects. The first of these studies, The 1977 National Survey of Science, Mathematics, and Social Studies Education, was part of a major National Science Foundation needs assessment effort. (A comprehensive literature review carried out by Stan Helgeson and his colleagues at Ohio State University and a series of case studies coordinated by Bob Stake and Jack Easley were also conducted as part of this needs assessment.)

The instrument development process for our survey was guided by a series of questions identified by NSF in the request for proposals (RFP).[1]

1. What science courses are currently offered in schools?

2. What local and state guidelines exist for the specification of minimal science experiences for students?

3. What texts, laboratory manuals, curriculum kits, modules, etc., are being used in science classrooms?

4. What share of the market is held by specific textbooks at the various grade levels and subject areas?

1/ Survey of Materials Usage in Pre-College Education, National Science Foundation Request for Proposal, NSF 76-108, Enclosure 1, pages 2-3. "Science" was defined as including mathematics, social science, and natural science.

5. What regional patterns of curriculum usage are evident? What patterns exist with respect to urban, suburban, rural, and other geographic variables?

6. What "hands-on" materials, such as laboratory or activity centered materials, are being used? What is the extent and frequency of their use by grade level and subject matter?

7. What audio-visual materials (films, filmstrips/loops, models) are used? What is the extent, frequency and nature of their use by grade level and subject area?

8. By grade level, how much time (in comparison with other subjects) is spent on teaching science?

9. What is the role of the science teacher in working with students? How has this role changed in the past 15 years? What commonalities exist in the teaching styles/strategies/practices of science teachers throughout the United States?

10. What are the roles of science supervisory specialists at the local district and state levels? How are they selected? What are their qualifications?

11. How have science teachers throughout the United States been influenced in their use of materials by federally supported in-service training efforts in science?

Note that while all of these questions represented legitimate needs for information on NSF's part, some of them simply could not be answered using a survey methodology. For example, it is hard to imagine how one could use a survey to find out how the role of the science teacher has changed in the last 15 years. One could certainly gather data about the current role, but since there was no accepted description of the role of a science teacher 15 years previously, comparisons would not be possible. Others of the RFP questions could be answered only with great difficulty. While it is certainly possible to use a survey to find out the names of films, filmstrips, texts, laboratory manuals, curriculum kits, modules, etc. being used in science classes, to do so would require a vast amount of effort and expense.

Had a set of agreed-upon indicators for science and mathematics education been available at that time, the process of instrument development would have been greatly simplified. In the absence of specific indicators, and with only a set of rather general and sometimes problematic questions as a guide, the instrument development process was somewhat capricious. We did have the advantage of working with an excellent advisory panel comprised of people

knowledgeable about both science education and data collection. Still, without a clear, research-supported model of the science and mathematics education process and the data that would provide acceptable indicators of the health of science and mathematics education, it was extremely difficult to make decisions about questionnaire content. There are many, many aspects of science and mathematics education that "it would be interesting" to know about; a set of indicators can help set priorities among them and make sure that available data collection resources are used as wisely as possible.

If one is attempting to describe the status of science and mathematics education, there is almost no limit to the amount of relevant data that could be collected. Should we determine the square footage of science classrooms? The number of water faucets? The amount of time spent on hands-on activities? The amount of homework assigned? The number of windows facing south? Clearly the answers depend on one's view of the educational process: it is important to collect data on variables that are believed to be causally related to the primary outcomes of interest (e.g., student achievement) and senseless to look at variables that are unlikely to be related to these outcomes (e.g., the percent of nitrogen in the air).

Each person who worked on the development of instruments for the 1977 survey had his or her own implicit model of the science and mathematics education process, sometimes based on research evidence, but more often than not based on his or her particular experiences as a science educator. Since we had no explicit, agreed-upon conceptual model, and no pre-defined indicators, we often found ourselves in lengthy debates about the importance of particular types of information.

With the advantage of hindsight, I would like to give you a few examples of what we did right and what we did wrong in the 1977 survey, in each case using our best collective judgment but without the guidance a set of indicators would have provided. Recall that the NSF Request for Proposals had listed questions about which textbooks, films, etc. were being used in the nation's schools. Since a single class might use dozens of different films, filmstrips, film loops, etc. the decision was made to ask about the frequency of use of each type of material rather than to get lists of specific titles. A multiple-choice question that needed no further coding would suffice, thus greatly simplifying both data collection and data processing. Since no one has come along and said that they really needed to know the specific titles of

films being used in order to make policy decisions, I have never had cause to regret this "short-cut." In fact, our advisory panel was so unimpressed with this topic that this question was not included in the 1985 survey at all.

For some reason, based on somebody's intuition (I'd like to take credit, but I don't think it was mine) the decision was made to get detailed information about textbook usage. Most of us had been in science and mathematics classrooms and knew that textbooks played a dominant role, but it was not clear that it mattered a great deal which particular textbook was being used. Nevertheless, we went ahead and collected this information. And what an undertaking that was--first developing a fairly comprehensive list of textbooks by using publisher catalogs and the textbook adoption lists of the most populous states, and then assigning code numbers to the textbooks teachers listed as "other."

As it turned out, the decision to collect detailed information on textbook usage was a good one, even given the difficulty and expense of data collection and analysis. The list of most commonly used textbooks has been used by a variety of groups for a number of different purposes. For example, several of the Project Synthesis task forces studied these books to describe the current state of science education with respect to important educational objectives, and the Second International Science Assessment did a content analysis of these textbooks to help determine the topics that should be included in its assessment. The importance of collecting textbook usage data was emphasized by the Committee on Indicators of Precollege Science and Mathematics Education, which stated that "periodic surveys should be conducted to determine the relative frequency of use of various mathematics and science textbooks at each grade level in elementary school and for science and mathematics courses in secondary school" (Raizen and Jones, 1985).

Now for an example where our judgment has turned out to be not so good. In the 1977 survey, course enrollment data for all science and mathematics courses offered in the school were collected from secondary principals. As anyone who has ever tried to develop a course taxonomy can attest, attempting to make sense of the myriad of high school course titles is a very difficult task. At the time, we considered asking for enrollment data by race and sex but discarded the idea based on the tremendous response burden it would represent and the resulting likely effect on response rates. While schools routinely keep course enrollment data, principals do not usually have easy

access to data on enrollment by race and sex for individual courses. This question was also considered for inclusion in the teacher questionnaire since each teacher would be asked about enrollment in only a single, randomly selected class and could easily tally the numbers by race and sex. But no one had yet specified gender/ethnicity data as an essential indicator, and this item was dropped in favor of some other items perceived at the time to be of higher priority.

As it turns out, this decision was unfortunate. While I realize my perspective may be biased by the fact that shortly after the 1977 survey my own work began to focus on women and minorities in science, I believe these data would have been extremely useful, and a number of people over the years have expressed disappointment that they were not collected in our survey. And, in fact, the National Research Council Committee on Indicators has now recommended that enrollment data for underrepresented groups be collected on a regular basis (Raizen and Jones, 1985).

Thus far I have focused on the 1977 survey, describing some of the data that were collected and their relationship to indicators that have since been developed. The remainder of this paper looks at the extent to which the 1985 National Survey will provide data relevant to the key indicators identified by the National Research Council.

The 1985 National Survey of Science and Mathematics Education focused on principals and teachers as data sources. In large part this decision was made because while a lot of effort in the 1977 survey had gone into collecting data from state and local supervisors and district superintendents, the most heavily used data were those that principals and teachers had provided. As was the case in the 1977 survey, RTI had the assistance of a very knowledgeable advisory panel of science and mathematics educators in developing the instruments. While there are no findings to report as yet, I can describe the instrument development process and the contents of the final instruments. I can also comment on some of the problems encountered in trying to collect these data.

My first and most important point is that it is not as easy as it looks. Consider the approval process. Before you can conduct a survey in the schools you must get permission from a lot of different people. The accuracy of your data depends heavily on your response rate--and you certainly don't want to lose the possibility of responses from a segment of your sample because you failed to secure the necessary clearances--but the approval process can be very trying.

Federally funded surveys usually require that you obtain OMB clearance, often a time-consuming process. And while OMB clearance may be necessary, unfortunately it is not sufficient. Protocol demands that the chief education officer in each state be contacted prior to contact with any local education agency personnel. Most state commissioners of education will not approve a survey unless the Council of Chief State School Officers' Committee on Evaluation and Information Systems (CEIS) endorses it. CEIS meets only twice a year and usually won't approve a study until it has seen final instruments, so you have to work your instrument development and field test schedule around the CEIS meeting dates. Even with CEIS endorsement there is no guarantee that each state commissioner will give permission to conduct the survey in his/her state. Persistence usually pays off, but often the delays wreak havoc on a data collection schedule.

At this point, the data collection effort moves from dealing with 50 or so state organizations to the hundreds or sometimes thousands of districts in the sample. Protocol dictates that the district superintendent be informed which schools have been selected, the number of teachers that will be contacted, and how they will be chosen. One can either request explicit permission, and then wait or follow-up until it is received, or give the superintendents an opportunity to contact project staff if they have any questions or concerns. Some districts, especially the larger ones and ones in close proximity to universities (and therefore besieged by researchers), have their own procedures for approval of research efforts, and sometimes these can take weeks or even months.

Once district permission is obtained, the schools may be contacted. In the ideal case, the superintendent will have complied with the request to notify selected schools of his/her approval and the principals will recall having been so notified. But superintendents and principals are busy people, and external research efforts are not high on their priority lists. Sometimes there are further delays while the principal tries to verify approval. It is also important to realize that the superintendents do not typically dictate cooperation with a survey; they simply give permission to contact the schools. The principal and the teachers can still refuse to participate.

There is an additional problem in attempting to select a sample of teachers to be surveyed. While one can purchase data tapes with sufficiently accurate data on the population of schools in the United States for use as a

sampling frame, there is no comparable listing of teachers within schools. Some studies have sent a batch of questionnaires to each school with instructions for selecting a sample of teachers, but there is serious concern about possible bias in these procedures. Therefore, in order to select a teacher sample, it is necessary to get a list of teachers along with information about the subjects they teach. In both the 1977 and the 1985 surveys, some questions focused on a single class, so it was also necessary to find out how many classes of each subject each teacher taught.

As you can imagine, it is not always easy to get detailed information about teachers. Again, persistence pays off; sometimes schools provided the information just so we would stop calling them. Flexibility on the part of the project staff is also essential. For example, in some cases schools had concerns about privacy and confidentiality and would agree only to list codes rather than teacher names.

By now it should be evident why knowledgeable people are saying it is important to identify a small set of key indicators. Collecting high-quality survey data is difficult and very expensive, and these problems are minor compared to the problems associated with collecting generalizable observational data!

Table 1 shows the data collected by the 1985 survey in each of the National Research Council's key indicator categories. For those who wish to see the questionnaire items in greater detail, copies of the instruments used for secondary science teachers and secondary principals are included in Appendix A.

Some of these data have been relatively easy to collect. For example, instructional time has been shown to be directly related to student achievement, and homework has been identified as an inexpensive means of increasing instructional time. The 1985 survey asked the teachers to provide an estimate of the amount of science homework a typical student in the target class was expected to complete each day (secondary) or week (elementary). Other than some non-response and a very few nonsensical answers, this item has not caused any problems. [Of course, now that I've seen a recent synthesis of research on teaching (Walberg & Rasher, 1985) I wish we'd tried to find out more about <u>how</u> homework is used to support instruction in science and mathematics classes.]

In contrast to the relative ease with which data on amount of homework assigned were collected, data on teacher preparation have been extremely difficult to obtain. The National Science Board Commission on Precollege

Table 1

1985 National Survey of Science and Mathematics Education
Education Data by Indicator Category

Indicator Category[1]		Data Collected	Questionnaire Type and Item No.
A. Teachers	1.	Course background preparation	Teacher--39,40
	2.	Degrees and certification status	Teacher--38,41,42
	3.	Teaching experience	Teacher--4,5,6
	4.	In-service education	Teacher--43,46, 50,52
	5.	Membership in professional organizations	Teacher--53
	6.	Use of journals	Teacher--20
	7.	Attitudes toward teaching science	Teacher--54
	8.	Teacher perceptions of their qualifications to teach science	Teacher--11
	9.	Principal ratings of the competence of teachers in their schools	Principal--24,25,26
B. Curriculum Content	1.	Textbook selection process	Teacher--27
	2.	Textbook used; copyright dates	Teacher--24
	3.	Percent of textbook "covered"	Teacher--25
	4.	Teacher ratings of textbook	Teacher--26
	5.	Course title	Teacher--14
	6.	Course objectives	Teacher--34
	7.	Subject matter emphasis	Teacher--17
	8.	Availability of science equipment, materials	Principal--15 Teacher--31
C. Instructional Time and Course Enrollments	1.	Time spent on science and mathematics instruction	Teacher--8,35a
	2.	Instructional time as a proportion of allocated time	Teacher--35b
	3.	Amount of homework	Teacher--19
	4.	Instructional techniques, including use of hands-on	Teacher--37
	5.	Course offerings	Principal--22
	6.	Course enrollments by race/sex	Teacher--15b
D. Student Outcomes		Not measured	

[1] These indicator categories were developed by the National Research Council's Committee on Indicators of Precollege Science and Mathematics Education (Raizen and Jones, 1985).

Education in Mathematics, Science and Technology indicated that "all available evidence suggests that there are currently severe shortages of qualified mathematics, science and technology teachers in many parts of the Nation." (NSB, 1983). Others have concluded that we simply do not have adequate information on the qualifications of the teachers who are responsible for teaching science and mathematics (Raizen and Jones, 1985). Part of the reason for the discrepant opinions is the lack of an agreed-upon measure of teacher quality.

It seems completely reasonable, even self-evident, that teachers who have completed a large number of college courses in a discipline would have a better grasp of the subject matter and would consequently be better able to convey this knowledge to their students. After all, you can't teach something you don't know. Unfortunately, there is little agreement about the amount of subject matter knowledge necessary for effective teaching or the appropriate mix of subject matter knowledge and knowledge of pedagogy. Even worse, extensive research on teaching has failed to demonstrate a direct relationship between teacher subject matter knowledge and student performance. (See, for example, Druva and Anderson's 1983 meta-analysis of research on science teacher characteristics and student outcomes.)

While one can't say with any certainty what a teacher <u>should</u> know in order to be effective, there seems to be a general perception that many teachers of science and mathematics have inadequate subject matter backgrounds. While data on teacher certification status are sometimes available, they are of little use as indicators of subject matter preparation, given the myriad of certificate types even within a single state and the large variation in requirements across states. For example, a "certified" middle school science teacher might have a K-8 certification having completed only a single college science course, or a 7-12 science certification that required the equivalent of a college major in a science field. And requirements for a particular certificate change over time, so that two teachers certified at different times in the same state might have satisfied very different requirements.

For the 1985 National Survey the decision was made to collect data on certification status and also to find out about teachers' subject matter preparation. As it turned out, more time and effort were spent on the development of these questions than on any other part of the questionnaire, constantly compromising between information needs and data collection constraints.

In the case of teacher subject matter preparation, possible definitions of indicators were available. Both the National Council of Teachers of Mathematics and the National Science Teachers Association had published standards for the preparation of elementary, middle/junior high school, and secondary school teachers. It would be important to know the percentages of science and mathematics teachers who meet or exceed these standards, and to provide a baseline for determining how teacher preparation is changing over time.

It was clear from the outset that it would be difficult to collect these data, but we never anticipated just how tough it would be. The standards were typically expressed in terms of credit hours in a particular subject, but field test teachers had difficulty recalling the exact number of credits and all too frequently noted that they were not sure, and then left the questions blank. Using ranges (0, 1-3, 4-6 credits, etc.) helped some, but not enough. It was even difficult to develop the lists of courses: we had to contend with the diversity of ways in which colleges and universities package their science, mathematics, and computer science course offerings while somehow keeping the lists down to a manageable size. Then there was the problem of quarter hour vs. semester hour courses. Many teachers have had some of each so it was not possible to have them indicate the unit once for the entire course list. An awesome-looking matrix was developed with separate columns for semester hour and quarter courses with credit ranges in each and, as was anticipated, teachers blanched when they got to that page.

To make a long story short, these items were revised, field tested and revised some more until we ran out of time because we had to send the questionnaires to the printer. These data have not yet been analyzed, but they <u>have</u> been edited, and it is clear that the questions are still a long way from perfect! We are hoping to do a validity study by analyzing transcripts of a sample of teachers, but even a transcript study would leave a lot of questions unanswered. For example, on a particular campus Introductory Physics may actually be "Calculus Physics" or it might be what some campuses refer to as "Physics for Poets." It is doubtful that <u>any</u> survey, using transcripts or not, can tell us what we really want to know about teacher preparation: Regardless of courses completed, how well do teachers actually know their subject matter and how skillful are they in using their knowledge to diagnose and address their students' needs?

Next time I do a survey of science and mathematics education (perhaps the 1990 National Survey of Science and Mathematics Education; it takes me a few years to recover from one of these efforts), I hope there is a detailed, research-based, conceptual model of the educational process that we can use, along with definitions of indicators. In addition to work completed and currently underway at the National Research Council, the work on indicators being carried out at Rand and at The Wisconsin Center for Education Research should be very useful in this regard. Having a set of indicators will not solve many of the data collection problems discussed in this paper, but it will at least help ensure that all of this effort will result in data that can be used to assess the overall health of science and mathematics education.

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Appendix A

Secondary Science Teacher and
Secondary Principal Questionnaires

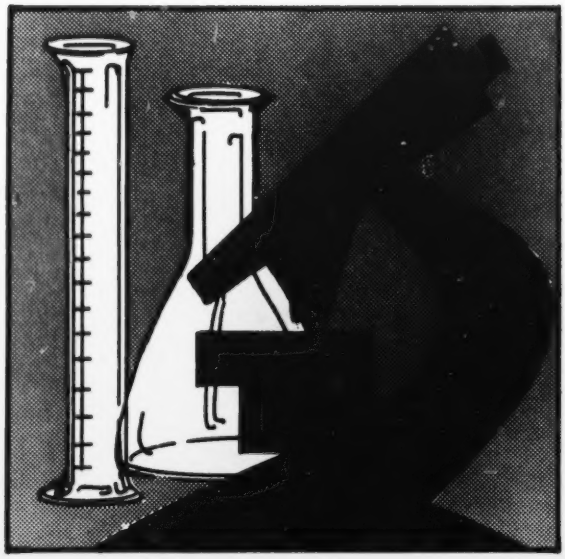
Appendix A

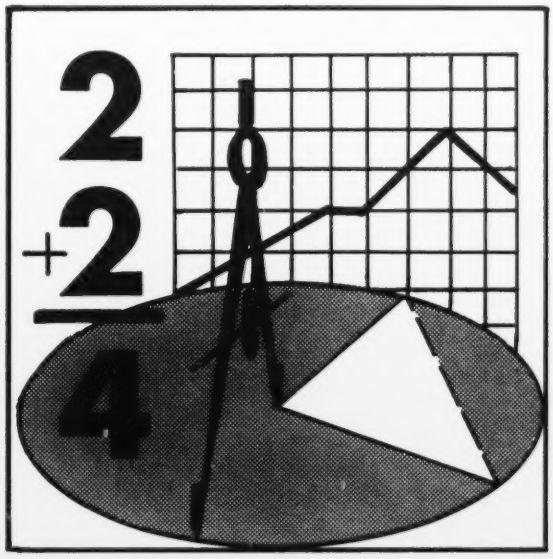
Secondary Science Teacher and
Secondary Principal Questionnaires

This appendix includes copies of the instruments used for secondary principals and secondary science teachers.

The questionnaires used for elementary teachers and principals, and for mathematics teachers, differed slightly.

1985 NATIONAL SURVEY SCIENCE & MATHEMATICS EDUCATION





Teacher Questionnaire

Conducted by Research Triangle Institute
P.O. Box 12194 Research Triangle Park, NC 27709

If you have any questions, call Jennifer McNeill 800-334-8571

Many educators have raised questions about how best to prepare young people for the challenges they will face in our increasingly technological society.

To help collect information on the status of science and mathematics education in our schools, the National Science Foundation sponsored a 1977 survey of teachers and principals. The purpose of the current study is to identify trends that have emerged since that time, and to suggest improvements that might be made in the future.

The topics to be covered in this study include science and mathematics course offerings and enrollments, availability of facilities and equipment, instructional techniques, textbook usage, teacher background, and needs for in-service education. Information will be collected from selected teachers and principals by printed questionnaire only—no classroom visits will be involved. Data will be kept strictly confidential, and will be reported only in aggregate form, such as by grade level, and by region. No individually identifying information will be released.

The 1985 National Survey of Science and Mathematics Education has been coordinated with the data collection efforts of the Department of Education, the National Assessment of Educational Progress, and the International Assessments of Science and Mathematics in order to avoid unnecessary duplication. The survey has also been endorsed by more than 20 professional organizations, whose names appear below.

Endorsed by:

American Association for the Advancement of Science (AAAS)
American Association of School Administrators (AASA)
American Association of Physics Teachers (AAPT)
American Chemical Society (ACS)
American Federation of Teachers (AFT)
American Institute of Biological Sciences (AIBS)
Association for Computing Machinery (ACM)
Association of State Supervisors of Mathematics (ASSM)
Council of Chief State School Officers (CCSSO)
Council of State Science Supervisors (CSSS)
National Association for Research in Science Teaching (NARST)
National Association of Biology Teachers (NABT)
National Association of Elementary School Principals (NAESP)
National Association of Geology Teachers (NAGT)
National Association of Secondary School Principals (NASSP)
National Catholic Education Association (NCEA)
National Council of Teachers of Mathematics (NCTM)
National Earth Science Teachers Association (NESTA)
National Education Association (NEA)
National Science Supervisors Association (NSSA)
National Science Teachers Association (NSTA)
School Science and Mathematics Association (SSMA)

SECTION A: BACKGROUND INFORMATION

1. **Indicate your sex:**

(Circle one.)

Male 1
Female 2

2. **Are you:**

(Circle one.)

White (not of Hispanic origin) 1
Black (not of Hispanic origin) 2
Hispanic 3
American Indian or Alaskan Native 4
Asian or Pacific Islander 5
Other *(please specify* _____ *)* 6

3. **How old are you?** _____

4. **How many years have you taught prior to this school year?** _____

5. **Indicate the number of years you have taught each of the following in any of grades 7-12 prior to this school year.**

If none, check here ☐ **and go on to Question 6.**

Mathematics, grades 7-12 _____

Science, grades 7-12 _____

6. **Which of the following subjects have you taught *in the last three years?***

If you have not taught mathematics or science in the last three years, check here ☐ **and go on to Question 7.**

MATHEMATICS/COMPUTER SCIENCE (Circle all that apply.)

Mathematics, grades 7-8 1
Remedial, business, consumer, or general mathematics 2
Pre-algebra 3
Algebra, 1st year 4
Algebra, 2nd year 5
Geometry 6
Calculus, advanced mathematics 7
Computer literacy, programming 8

SCIENCE

General science 9
Biology, environmental, life sciences 10
Chemistry 11
Physics 12
Physical science 13
Earth/space sciences 14

SECTION B: SCIENCE INSTRUCTION IN YOUR SCHOOL

7. Do you teach in a self-contained classroom, i.e., are you responsible for teaching all or most academic subjects to one class?

(Circle one.)

Yes ..... 1 *Specify grade level(s)* _____ *then go to Question 8*

No ..... 2 → *Go to Question 9*

8. We are interested in knowing how much time your students spend studying various subjects. In a typical week, how many days do you have lessons on each of the following subjects, and how many minutes long is an average lesson? (Please write "0" if you do not teach a particular subject to this class.)

	Number of Days per Week	Approximate Number of Minutes per Day
1. Mathematics	_____	_____
2. Science	_____	_____
3. Social studies	_____	_____
4. Reading	_____	_____

Go to Question 10

9. For each class period you are currently teaching, indicate the course title and the enrollment by grade. Then indicate the code number from the enclosed blue "List of Course Titles" that best describes the content of each course.

Class	Course Title	Number of Students in Class by Grade							Course Code Number
		7	8	9	10	11	12	Total	
1	_____	___	___	___	___	___	___	___	_____
2	_____	___	___	___	___	___	___	___	_____
3	_____	___	___	___	___	___	___	___	_____
4	_____	___	___	___	___	___	___	___	_____
5	_____	___	___	___	___	___	___	___	_____
6	_____	___	___	___	___	___	___	___	_____
7	_____	___	___	___	___	___	___	___	_____
8	_____	___	___	___	___	___	___	___	_____

10. Are you currently teaching any course(s) that are outside your major area of certification? If yes, write in the course code number(s) from the blue list.

(Circle one.)

Yes ..... 1 *Please specify:*

No 2

Course Code No.

a. _____

b. _____

c. _____

List of Course Titles

Subject Area	Code Number	Course Title
Science	101	Life science
	102	Earth science
	103	Physical science
	104	General science, grade 7
	105	General science, grade 8
	106	General science, grade 9
	107	General science, grades 10-12
	108	Biology, 1st year
	109	Chemistry, 1st year
	110	Physics, 1st year
	111	Biology, 2nd year
	112	Chemistry, 2nd year
	113	Physics, 2nd year
	114	Astronomy
	115	Anatomy
	116	Physiology
	117	Zoology
	118	Ecology, environmental science
	119	Other science
Mathematics	201	Mathematics, grade 7
	202	Mathematics, grade 8
	203	General mathematics, grade 9
	204	General mathematics, grades 10-12
	205	Business mathematics
	206	Consumer mathematics
	207	Remedial mathematics
	208	Pre-algebra/introduction to algebra
	209	Algebra, 1st year
	210	Algebra, 2nd year
	211	Geometry
	212	Trigonometry
	213	Probability/statistics
	214	Advanced senior mathematics, not including calculus
	215	Advanced senior mathematics, including some calculus
	216	Calculus
	217	Advanced placement calculus
	218	Other mathematics
Computer Science	301	Computer awareness or literacy
	302	Applications and implications of computers
	303	Introductory computer programming
	304	Advanced computer programming
	305	Advanced placement computer science
	306	Other computer science
Other	401	Social studies, history
	402	English, language arts, reading
	403	Business, vocational education
	404	Foreign languages
	405	Health, physical education
	406	Art, music, drama
	407	Other subject

11. **Are you currently teaching any course(s) that you *do not feel adequately qualified* to teach? If yes, write in the course code number(s) from the blue list.**

(Circle one.)			Course Code No.
Yes	1	*Please specify:*	a. _____
No	2		b. _____
			c. _____

12. a. **In the last year, have you received any assistance (e.g., curriculum materials, guest speakers, support to attend workshops, etc.) *from private industry?***

(Circle one.)

Yes	1	→ *Go to Question 12b*
No	2	→ *Go to Question 13*
Not sure	3	→ *Go to Question 13*

b. **Indicate the type(s) of assistance you have received.**

(Circle all that apply.)

Curriculum materials	1
Equipment	2
Guest speakers	3
Travel/stipends to attend professional meetings	4
Teacher awards/scholarships	5
Teacher summer employment	6
Other *(please specify* _____ *)*	7

13. **The following factors may affect science instruction *in your school as a whole.* In your opinion, how great a problem is caused by each of the following?**

(Circle one on each line.)

		Serious Problem	Somewhat of a Problem	Not a Significant Problem
a.	Belief that science is less important than other subjects	1	2	3
b.	Inadequate facilities	1	2	3
c.	Insufficient funds for purchasing equipment and supplies	1	2	3
d.	Lack of materials for individualizing instruction	1	2	3
e.	Insufficient numbers of textbooks	1	2	3
f.	Poor quality of textbooks	1	2	3
g.	Inadequate access to computers	1	2	3
h.	Lack of student interest in science	1	2	3
i.	Inadequate student reading abilities	1	2	3
j.	Lack of teacher interest in science	1	2	3
k.	Teachers inadequately prepared to teach science	1	2	3
l.	Student absences	1	2	3
m.	Lack of teacher planning time	1	2	3
n.	Not enough time to teach science	1	2	3
o.	Class sizes too large	1	2	3
p.	Difficulty in maintaining discipline	1	2	3
q.	Inadequate articulation of instruction across grade levels	1	2	3
r.	Inadequate diversity of science electives	1	2	3
s.	Low enrollments in science courses	1	2	3

SECTION C: YOUR SCIENCE TEACHING IN A PARTICULAR CLASS

The questions in Sections C and D relate to *your science teaching* in a particular class. Please consult the label on the front of this questionnaire to determine the randomly selected science class for which these questions should be answered.

14. a. What is the title of this course? _____

b. Using the blue "List of Course Titles," indicate the code number that best describes the content of this course.

_____

15. a. How many students are there in this class? _____

b. Please indicate the number of students in this class in each race/sex category:

	Male	Female
White (not of Hispanic origin)	_____	_____
Black (not of Hispanic origin)	_____	_____
Hispanic	_____	_____
American Indian or Alaskan Native	_____	_____
Asian or Pacific Islander	_____	_____
Other *(please specify* _____*)*	_____	_____
Total	_____	_____

Note: The total number of males and females should be the same as the number of students in Question 15a.

16. What is the duration of this course?

(Circle one.)

Year 1
Semester 2
Quarter 3
Other *(please specify* _____*)* 4

17. Which best describes the content of this course?

(Circle one.)

General science 1
Biology, life sciences, environmental science 2
Chemistry, physics, physical sciences 3
Earth/space sciences 4
Other *(please specify* _____*)* 5

18. Which of the following best describes the ability makeup of this class? (Comparison should be with the average student in the grade.)

(Circle one.)

Primarily high ability students 1
Primarily low ability students 2
Primarily average ability students 3
Students of widely differing ability levels 4

19. **On the average, how many minutes of science homework do you expect the typical student in this class to complete each day?**

_____ minutes/day

20. **Are there any professional magazines or journals which you find particularly helpful in teaching science to this class?**

(Circle one.)

Yes ..... 1 *Please specify:* a. _____
No ..... 2 b. _____
c. _____

21. **Are you using one or more published textbooks or programs for teaching science to this class?**

(Circle one.)

Yes ..... 1 → *Go to Question 23*
No ..... 2 → *Go to Question 22*

22. **Why did you choose not to use a textbook?**

(Circle all that apply.)

I prefer to teach without a textbook 1
I did not like the textbook assigned to this class 2
Available textbooks were not appropriate for this class 3
There were insufficient funds to purchase textbooks 4
Other *(specify* _____ 5
_____*)*

Go to Question 28

23. **Indicate the publisher of the *one* textbook/program used most often by the students in this class.**

(Circle one.)

Addison-Wesley 01
Allyn & Bacon 02
American Book 03
Wm. C. Brown 04
College Entrance 05
Coronado 06
Follett 07
Ginn 08
Globe 09
Harcourt, Brace, & Jovanovich 10
Harper & Row 11
D. C. Heath 12
Holt, Rinehart, Winston 13
Houghton Mifflin 14
Janus 15
Laidlaw Brothers 16
Little, Brown 17
Macmillan 18
McGraw Hill 19
Merrill 20
National Science Program 21
Prentice Hall 22
Rand McNally 23
Saunders 24
Scott, Foresman 25
Silver Burdett 26
Wiley 27
Other *(please specify* _____*)* .. 28

24. Indicate the title, author, and most recent copyright date of this textbook/program.

Title: _____

Author: _____

Most recent copyright date: _____

25. Approximately what percentage of the textbook will you "cover" in this course?

(Circle one.)

Less than 25% 1
25-49% 2
50-74% 3
75-90% 4
More than 90% 5

26. Please give us your opinion about each of the following statements related to the textbook you are using most often in this class.

(Circle one on each line.)

This textbook:	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
a. Is at an appropriate reading level for most of my students	1	2	3	4	5
b. Is not very interesting to my students	1	2	3	4	5
c. Is unclear and disorganized	1	2	3	4	5
d. Helps develop problem-solving skills	1	2	3	4	5
e. Needs more examples to reinforce concepts	1	2	3	4	5
f. Explains concepts clearly	1	2	3	4	5
g. Provides good suggestions for activities and assignments	1	2	3	4	5
h. Lacks examples of the use of science in daily life	1	2	3	4	5
i. Shows the applications of science in careers	1	2	3	4	5
j. Has high quality supplementary materials	1	2	3	4	5

27. Indicate the persons or groups who helped determine that you would use this particular textbook in this science class.

(Circle all that apply.)

I did 1
The principal 2
A group of teachers from this school 3
A district-wide textbook adoption committe 4
A state-wide textbook adoption committee 5
Other *(please specify* _____*)* ... 6

28. If you are using any materials instead of, or in addition to, a published textbook or program, briefly describe below.

_____

_____

_____

29. Do you use calculators in this science class?

(Circle one.)

Yes	1	→ *Go to Question 30*
No	2	→ *Go to Question 31*

30. How are calculators used in this science class?

(Circle all that apply.)

Checking answers	1
Doing computations	2
Solving problems	3
Taking tests	4

31. Which best describes the availability of computers (microcomputers or terminals to mini/mainframe) for use with this science class?

(Circle one.)

Not available	1	→ *Skip to Question 34*
Available but quite difficult to access	2	
Available but somewhat difficult to access	3	
Readily available	4	

32. How does this science class use computers?

If not used, check here ☐ and skip to Question 34.

(Circle all that apply.)

Teacher demonstrating computer use	1
Writing programs	2
Learning science content	3
Laboratory tool	4
Drill and practice	5
Using simulations	6
Problem solving	7
Using computer graphics	8
Games	9
Testing and evaluation	10
Other *(please specify* _____*)*	11

33. During the *last week* of instruction, how many minutes did a typical student spend working with computers as part of this science class?

(Circle one.)

None	1
1-14 minutes	2
15-29 minutes	3
30-44 minutes	4
45-60 minutes	5
More than 60 minutes	6

34. Think about your plans for this science class for the entire course. How much emphasis will each of the following *objectives* receive?

(Circle one on each line.)

	None	Minimal Emphasis		Moderate Emphasis		Very Heavy Emphasis
a. Become interested in science	1	2	3	4	5	6
b. Learn basic science concepts	1	2	3	4	5	6
c. Prepare for further study in science	1	2	3	4	5	6
d. Develop inquiry skills	1	2	3	4	5	6
e. Develop a systematic approach to solving problems	1	2	3	4	5	6
f. Learn to effectively communicate ideas in science	1	2	3	4	5	6
g. Become aware of the importance of science in daily life	1	2	3	4	5	6
h. Learn about applications of science in technology	1	2	3	4	5	6
i. Learn about the career relevance of science	1	2	3	4	5	6
j. Learn about the history of science	1	2	3	4	5	6
k. Develop awareness of safety issues in lab	1	2	3	4	5	6
l. Develop skill in lab techniques	1	2	3	4	5	6

SECTION D: YOUR MOST RECENT SCIENCE LESSON IN THIS CLASS

Please answer the following questions specific to *your most recent science lesson* in this class. Do not be concerned if this lesson was not typical of instruction in this class.

35. a. How many minutes were allocated for that science lesson? _____

b. Of these, how many were spent on the following:

Daily routines, interruptions, and other non-instructional activities _____

Lecture _____

Working with hands-on, manipulative, or laboratory materials _____

Reading about science _____

Test or quiz _____

Other science instructional activities _____

Total _____

(Should be the same as Question 35a)

36. Did that lesson take place on the most recent day your school was in session?

(Circle one.)

Yes 1

No 2

37. **Indicate the activities that took place during that science lesson.**

(Circle all that apply.)

Lecture	1
Discussion	2
Teacher demonstration	3
Student use of hands-on or laboratory materials	4
Student use of calculators	5
Student use of computers	6
Students working in small groups	7
Students doing seatwork assigned from textbook	8
Students completing supplemental worksheets	9
Assigning homework	10

SECTION E: TEACHER PREPARATION

38. **Indicate the degrees you hold. Then indicate your major area of study for each degree using the list of code numbers to the right. Space has been provided for you to enter a code number for a second bachelor's or master's degree. Enter more than one code number on the same line only if you had a double major.**

If no degree, check here ☐ and go on to Question 39.

Degree	(Circle all that apply.)	Specify Major Area Code No.
Associate	1	_____
Bachelor's	2	_____
2nd Bachelor's		_____
Master's	3	_____
2nd Master's		_____
Specialist or 6-year certificate	4	_____
Doctorate	5	_____

MAJOR AREA CODE NUMBERS

EDUCATION
- 11 Elementary education
- 12 Middle school education
- 13 Secondary education
- 14 Mathematics education
- 15 Science education
- 16 Other education

MATHEMATICS/COMPUTER SCIENCE
- 21 Mathematics
- 22 Computer science

SCIENCE
- 31 Biology, environmental, life sciences
- 32 Chemistry
- 33 Physics
- 34 Physical science
- 35 Earth/space sciences

OTHER DISCIPLINES
- 41 History, English, foreign language, etc.

39. Indicate the categories in which you have completed one or more college courses.

EDUCATION (Circle all that apply.)

- General methods of teaching 1
- Methods of teaching elementary school science 2
- Methods of teaching middle school science 3
- Methods of teaching secondary school science 4
- Supervised student teaching 5
- Instructional uses of computers 6
- Psychology, human development 7

MATHEMATICS/COMPUTER SCIENCE

- College algebra, trigonometry, elementary functions 8
- Calculus 9
- Differential equations 10
- Probability and statistics 11
- Computer programming 12

LIFE SCIENCES

- Introductory biology 13
- Botany, plant physiology, etc. 14
- Cell biology 15
- Ecology, environmental science 16
- Genetics, evolution 17
- Microbiology 18
- Physiology 19
- Zoology, animal behavior, etc. 20

CHEMISTRY

- General chemistry 21
- Analytical chemistry 22
- Organic chemistry 23
- Physical chemistry 24
- Biochemistry 25

PHYSICS

- General physics 26
- Electricity and magnetism 27
- Heat and thermodynamics 28
- Mechanics 29
- Modern or nuclear physics 30
- Optics 31

EARTH/SPACE SCIENCES

- Astronomy 32
- Geology 33
- Meteorology 34
- Oceanography 35
- Physical geography 36

OTHER

- History of science 37
- Science and society 38
- Engineering 39

40. For each of the following subject areas, indicate the number of courses you have completed. Count each course you have taken, regardless of whether it was a semester hour, quarter hour, graduate, or undergraduate course. If your transcripts are not available, provide your best estimates.

Subject Area	Circle the number of courses you have completed.
Life sciences	0 ... 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... ≥8
Chemistry	0 ... 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... ≥8
Physics/physical science	0 ... 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... ≥8
Earth/space sciences	0 ... 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... ≥8
Calculus	0 ... 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... ≥8
Computer science	0 ... 1 ... 2 ... 3 ... 4 ... 5 ... 6 ... 7 ... ≥8

41. What type of state teaching certification do you have?

(Circle one.)

Not certified ..... 1 → *Skip to Question 43*
Provisional (lacking some requirements) 2
Regular, lifetime, or other certification in *any* subject 3

42. In which subject areas do you have state teaching certification?

(Circle all that apply.)

Elementary education *(please specify grades: _____)* 1
Middle school education *(please specify grades: _____)* 2
General science 3
Biology, environmental, life sciences 4
Earth/space sciences 5
Physical sciences 6
Chemistry 7
Physics 8
Mathematics 9
Computer science 10
Business 11
English, language arts, reading 12
Physical education, health 13
Social studies, history 14
Foreign language 15
Other *(please specify _____)* 16

SECTION F: IN-SERVICE EDUCATION IN SCIENCE

43. During the *last 12 months*, what is the *total* amount of time you have spent on in-service education in science or the teaching of science? (Include attendance at professional meetings, workshops, and conferences, but do *not* include formal courses for which you received college credit.)

(Circle one.)

None	1	→ *Skip to Question 45*
Less than 6 hours	2	
6-15 hours	3	
16-35 hours	4	
More than 35 hours	5	

44. What type(s) of support have you received?

(Circle all that apply.)

None	1
Released time from teaching	2
Travel and/or per diem expenses	3
Stipends	4
Professional growth credits	5
Other *(please specify* _____*)*	6

45. If an in-service program that interested you were available, how likely would you be to attend if it were offered at the following times?

(Circle one on each line.)

	Not Likely	Somewhat Likely	Very Likely
a. After school	1	2	3
b. Evenings	1	2	3
c. Saturdays	1	2	3
d. Summers	1	2	3
e. Teacher work days	1	2	3

46. In what year did you last take a course *for college credit* in science or the teaching of science? _____

47. Think about a specific science topic that you would find difficult to teach.

a. What is this topic? _____

b. Which would be the *most* useful in helping you to teach that topic?

(Circle one.)

Learning more about the basic concepts	1
Learning more about applications of those concepts in daily life, technology, and careers	2
Learning more about instructional materials/techniques	3

48. **Suppose you wanted to find out about the research related to a topic (e.g., discovery learning, science anxiety, or sex differences in learning). How likely would you be to use each of the following sources of information?**

(Circle one on each line.)

	Not Likely	Somewhat Likely	Very Likely
a. Other teacher(s)	1	2	3
b. Principals	1	2	3
c. Local science specialists/coordinators	1	2	3
d. State Department personnel	1	2	3
e. Consultants	1	2	3
f. College courses	1	2	3
g. In-service programs	1	2	3
h. Meetings of professional organizations	1	2	3
i. Journals	1	2	3
j. Research reviews	1	2	3
k. Newspapers/magazines	1	2	3
l. Television/radio	1	2	3
m. Publishers and sales representatives	1	2	3

49. **How adequately prepared do you feel to teach science in a class that includes the following types of children with special needs?**

(Circle one on each line.)

	Totally Unprepared	Somewhat Unprepared	Adequately Prepared	Well Prepared	Very Well Prepared
a. Physically handicapped	1	2	3	4	5
b. Mentally retarded	1	2	3	4	5
c. Learning disabled	1	2	3	4	5

50. **What training have you received in educating handicapped children in the regular science classroom?**

(Circle all that apply.)

None . . . 1
College course(s) . . . 2
In-service workshop(s) . . . 3
Other *(please specify* _____*)* . . . 4

51. **How adequately prepared do you feel to use computers as an instructional tool with your science classes?**

(Circle one.)

Totally unprepared . . . 1
Somewhat unprepared . . . 2
Adequately prepared . . . 3
Well prepared . . . 4
Very well prepared . . . 5

52. **What training have you received in the *instructional uses* of computers?**

(Circle all that apply.)

None . . . 1
College coursework . . . 2
Less than 3 days' in-service education . . . 3
Three or more days' in-service education . . . 4
Self-taught . . . 5
Other *(please specify* _____*)* . . . 6

53. To which of the following professional organizations do you currently belong?

If none, check here ☐ and go on to Question 54.

(Circle all that apply.)

American Association of Physics Teachers 1
American Chemical Society 2
National Association of Biology Teachers 3
National Association of Geology Teachers 4
National Earth Science Teachers Association 5
National Science Teachers Association 6
School Science and Mathematics Association 7
State-level science education organization 8

Association for Computing Machinery 9
Association for Educational Data Systems 10
Mathematical Association of America 11
National Council of Teachers of Mathematics 12
Society of Industrial and Applied Mathematics 13
State-level mathematics education organization 14

American Federation of Teachers 15
National Education Association 16

Other *(please specify)* _____) 17

54. Please give us your opinion about each of the following statements.

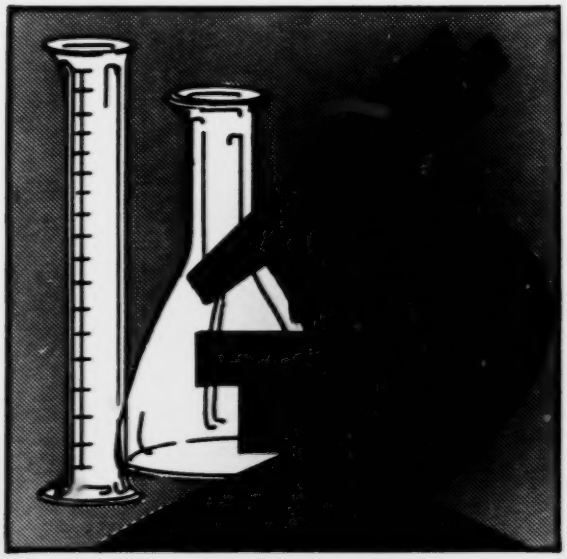
(Circle one on each line.)

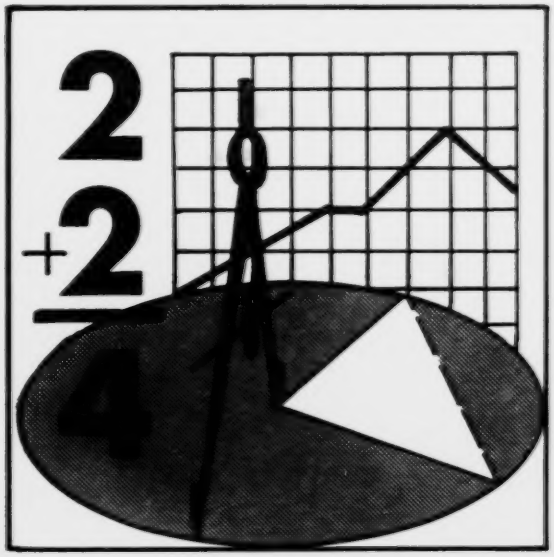
	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
a. I am in favor of differential pay for teachers in shortage areas such as science	1	2	3	4	5
b. Science is a difficult subject for children to learn	1	2	3	4	5
c. Prospective teachers should have to pass competency tests in science	1	2	3	4	5
d. Hands-on science experiences aren't worth the time and expense	1	2	3	4	5
e. I would like an 11-month contract	1	2	3	4	5
f. My principal really does not understand the problems of teaching science	1	2	3	4	5
g. Experienced teachers should be required to pass competency tests in science	1	2	3	4	5
h. I enjoy teaching science	1	2	3	4	5
i. Laboratory-based science classes are more effective than non-laboratory classes	1	2	3	4	5
j. Industry scientists should be allowed to teach in the public schools	1	2	3	4	5
k. I consider myself a "master" science teacher	1	2	3	4	5

55. When did you complete this questionnaire? _____ (Month) _____ (Day) _____ (Year)

THANK YOU FOR YOUR COOPERATION!

1985 NATIONAL SURVEY SCIENCE & MATHEMATICS EDUCATION





Principal Questionnaire

Conducted by Research Triangle Institute
P.O. Box 12194 Research Triangle Park, NC 27709

If you have any questions, call Jennifer McNeill 800-334-8571

S

Many educators have raised questions about how best to prepare young people for the challenges they will face in our increasingly technological society.

To help collect information on the status of science and mathematics education in our schools, the National Science Foundation sponsored a 1977 survey of teachers and principals. The purpose of the current study is to identify trends that have emerged since that time, and to suggest improvements that might be made in the future.

The topics to be covered in this study include science and mathematics course offerings and enrollments, availability of facilities and equipment, instructional techniques, textbook usage, teacher background, and needs for in-service education. Information will be collected from selected teachers and principals by printed questionnaire only—no classroom visits will be involved. Data will be kept strictly confidential, and will be reported only in aggregate form, such as by grade level, and by region. No individually identifying information will be released.

The 1985 National Survey of Science and Mathematics Education has been coordinated with the data collection efforts of the Department of Education, the National Assessment of Educational Progress, and the International Assessments of Science and Mathematics in order to avoid unnecessary duplication. The survey has also been endorsed by more than 20 professional organizations, whose names appear below.

Endorsed by:

American Association for the Advancement of Science (AAAS)
American Association of School Administrators (AASA)
American Association of Physics Teachers (AAPT)
American Chemical Society (ACS)
American Federation of Teachers (AFT)
American Institute of Biological Sciences (AIBS)
Association for Computing Machinery (ACM)
Association of State Supervisors of Mathematics (ASSM)
Council of Chief State School Officers (CCSSO)
Council of State Science Supervisors (CSSS)
National Association for Research in Science Teaching (NARST)
National Association of Biology Teachers (NABT)
National Association of Elementary School Principals (NAESP)
National Association of Geology Teachers (NAGT)
National Association of Secondary School Principals (NASSP)
National Catholic Education Association (NCEA)
National Council of Teachers of Mathematics (NCTM)
National Earth Science Teachers Association (NESTA)
National Education Association (NEA)
National Science Supervisors Association (NSSA)
National Science Teachers Association (NSTA)
School Science and Mathematics Association (SSMA)

SECTION A: PRINCIPAL BACKGROUND INFORMATION

1. **Indicate your sex:**

(Circle one.)

Male 1
Female 2

2. **Are you:**

(Circle one.)

White (not of Hispanic origin) 1
Black (not of Hispanic origin) 2
Hispanic 3
American Indian or Alaskan Native 4
Asian or Pacific Islander 5
Other *(please specify* _____ *)* 6

3. **How old are you?** _____

4. **How many years teaching experience did you have prior to becoming a principal?** _____

5. **Prior to this school year, how many years have you been:**

a. A principal? _____

b. The principal at this school? _____

6. **Which of the following was your undergraduate major in college?**
(If you majored in education, check here ☐ and indicate the subject area of greatest concentration.)

(Circle one.)

Mathematics 1
Science 2
Computer science 3
Social studies/history 4
Reading, language arts, English 5
Physical education/health 6
Fine arts 7
Vocational, business education 8
Foreign language 9
Other subject area *(please specify* _____*)* ... 10

SECTION B: SCHOOL BACKGROUND INFORMATION

7. **How many students are there in your school (first month's average daily membership)?** _____

8. **Indicate the grades included in this school.**

(Circle all that apply.)

K 1 2 3 4 5 6 7 8 9 10 11 12 Special

9. **Which best describes the location of your school?**

(Circle one.)

Inner city 1
Urban, but not inner city 2
Suburb 3
Rural 4

10. **Does your school qualify for ECIA Chapter 1 assistance?**

(Circle one.)

Yes → Specify approximate number of students qualifying for Chapter 1 assistance: _____ 1
No 2
Don't know 3

11. **Approximately what percentage of the students attending your school are children of:**

_____ a. Professional or managerial personnel

_____ b. Sales, clerical, technical, or skilled workers

_____ c. Factory or other blue collar workers

_____ d. Farm workers

_____ e. Persons not regularly employed

_____ f. Persons on welfare

100% Total (Items a-f should add to 100%).

12. **Approximately what percentage of the students attending your school are:**

_____ a. White (not of Hispanic origin)

_____ b. Black (not of Hispanic origin)

_____ c. Hispanic, regardless of race (Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin)

_____ d. American Indian or Alaskan Native

_____ e. Asian or Pacific Islander

_____ f. Other *(please specify* _____*)*

100% Total (Items a-f should add to 100%)

SECTION C: SCIENCE AND MATHEMATICS INSTRUCTION IN YOUR SCHOOL

13. Most principals feel better qualified in some areas than in others. How qualified do you feel to assist teachers in improving instruction in each of the following subject areas?

(Circle one on each line.)

	Not Well Qualified	Adequately Qualified	Very Well Qualified
a. Mathematics	1	2	3
b. Life sciences	1	2	3
c. Physical sciences	1	2	3
d. Earth/space sciences	1	2	3
e. Social studies, history	1	2	3
f. Reading, language arts, English	1	2	3

14. During the last three years, have you attended any workshops or conferences related to:

(Circle one on each line.)

	Yes	No
a. Mathematics teaching	1	2
b. Science teaching	1	2
c. Reading/language arts, English teaching	1	2
d. Social studies/history teaching	1	2
e. Instructional leadership	1	2
f. School organization/management	1	2
g. Instructional uses of computers	1	2
h. Administrative uses of computers	1	2

15. Which of the following instructional resources are available to students in your school?

(Circle all that apply.)

Microcomputers	1
Terminals connected to mini/mainframe computers	2
Greenhouse	3
Telescope	4
Darkroom	5
Weather station	6
Hand-held calculators	7
Microscopes	8
Cameras	9
Models (e.g., of the solar system, parts of organisms, mathematical figures)	10
Small group meeting rooms	11
Learning resource center	12
Mathematics laboratory	13
Science laboratory	14
Outdoor study area	15
Vivarium	16
Portable planetarium	17
Videocassette recorder	18
Videodisc players	19

16. **Is anyone in your building (other than the principal) specifically designated to coordinate or supervise:**

(Circle one on each line.)

	Yes	No
a. Mathematics instruction	1	2
b. Science instruction	1	2
c. Instructional uses of computers	1	2

17. **Please give us your opinion about each of the following statements.**

(Circle one on each line.)

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
a. I am in favor of differential pay for teachers in shortage areas such as science and mathematics	1	2	3	4	5
b. Science is a difficult subject for children to learn	1	2	3	4	5
c. Prospective teachers should have to pass competency tests in the subjects they will teach	1	2	3	4	5
d. Hands-on science experiences aren't worth the time and expense	1	2	3	4	5
e. Experienced teachers should be required to pass competency tests in the subjects they teach	1	2	3	4	5
f. Laboratory-based science classes are more effective than non-laboratory classes	1	2	3	4	5
g. Mathematics is a difficult subject for children to learn	1	2	3	4	5
h. Industry scientists and mathematicians should be allowed to teach in the public schools	1	2	3	4	5

18. **Does your school use computers (microcomputers or terminals to mini/mainframe) as part of the students' instructional program?**

(Circle one.)

Yes ..... 1→ *Go to Question 19*

No ..... 2→ *Skip to Question 21*

19. **In what year did you first have computers available for instructional use?**

(Circle one.)

Before 1980 1

1980 2

1981 3

1982 4

1983 5

1984 6

1985 7

20. **a. How many computers does your school now have that students can use?**

_____ Terminals (to mini/mainframe)

_____ Microcomputers

_____ Total

b. How many of the total are:

Grouped in a central computer lab? _____

Distributed in classrooms? _____

21. **Here is a list of factors that may cause serious problems in mathematics and/or science instruction in your school. For each factor, indicate if it is a serious problem in these subjects.**

If none of these cause serious problems in either mathematics or science, check here ☐ and go on to Question 22.

(Circle all that apply on each line.)

		Mathematics	Science
a.	Belief that this subject is less important than other subjects	1	2
b.	Inadequate facilities	1	2
c.	Insufficient funds for purchasing equipment and supplies	1	2
d.	Lack of materials for individualizing instruction	1	2
e.	Insufficient number of textbooks	1	2
f.	Poor quality of textbooks	1	2
g.	Inadequate access to computers	1	2
h.	Lack of student interest in subject	1	2
i.	Inadequate student reading abilities	1	2
j.	Lack of teacher interest in subject	1	2
k.	Teachers inadequately prepared to teach subject	1	2
l.	Student absences	1	2
m.	Lack of teacher planning time	1	2
n.	Not enough time to teach subject	1	2
o.	Class sizes too large	1	2
p.	Difficulty in maintaining discipline	1	2
q.	Inadequate articulation of instruction across grade levels	1	2
r.	Inadequate diversity of electives	1	2
s.	Low enrollments in courses	1	2
t.	Mainstreaming of handicapped students	1	2
u.	"Pull-out" of students (e.g., Chapter 1, learning disabled)	1	2

22. Please indicate the number of sections of each science, mathematics, and computer science course currently offered in your school.

If any of your course offerings are not included in the list, please use the appropriate "other" area to record those sections.

NOTE: *Do not include the same course more than once.* For example, if 7th grade science in your school is actually life science, enter the number of sections as "Life Science," not "General Science, Grade 7."

SCIENCE	No. of Sections
a. Life science	_____
b. Earth science	_____
c. Physical science	_____
d. General science, grade 7	_____
e. General science, grade 8	_____
f. General science, grade 9	_____
g. General science, grades 10-12	_____
h. Biology, 1st year	_____
i. Chemistry, 1st year	_____
j. Physics, 1st year	_____
k. Biology, 2nd year	_____
l. Chemistry, 2nd year	_____
m. Physics, 2nd year	_____
n. Astronomy	_____
o. Anatomy	_____
p. Physiology	_____
q. Zoology	_____
r. Ecology, environmental science	_____
s. Other *(please specify)*	
1. _____	_____
2. _____	_____

MATHEMATICS	No. of Sections
a. Mathematics, grade 7	_____
b. Mathematics, grade 8	_____
c. General mathematics, grade 9	_____
d. General mathematics, grades 10-12	_____
e. Business mathematics	_____
f. Consumer mathematics	_____
g. Remedial mathematics	_____
h. Pre-algebra/introduction to algebra	_____
i. Algebra, 1st year	_____
j. Algebra, 2nd year	_____
k. Geometry	_____
l. Trigonometry	_____
m. Probability/statistics	_____
n. Advanced senior mathematics, not including calculus	_____
o. Advanced senior mathematics, including some calculus	_____
p. Calculus	_____
q. Advanced placement calculus	_____
r. Other *(please specify)*	
1. _____	_____
2. _____	_____

22. (continued)

COMPUTER SCIENCE	No. of Sections
a. Computer awareness or literacy	_____
b. Applications and implications of computers	_____
c. Introductory computer programming	_____
d. Advanced computer programming	_____
e. Advanced placement computer science	_____
f. Other *(please specify)*	
1. _____	_____
2. _____	_____

23. **Does your school find it difficult to hire fully qualified teachers for vacancies in each of the following fields?**

(Circle one on each line)

	Yes	No	No Vacancies/ Does Not Apply
a. Mathematics	1	2	3
b. Biology/life science	1	2	3
c. Chemistry	1	2	3
d. Physics	1	2	3
e. Physical science	1	2	3
f. Earth/space science	1	2	3
g. General science	1	2	3
h. Computer science	1	2	3
i. Foreign language	1	2	3
j. Social studies	1	2	3
k. Special education	1	2	3

24. a. **How many teachers in your school teach one or more classes of mathematics?** _____

b. **Of these, how many do you consider:**

1. Highly competent to teach mathematics _____
2. Competent to teach mathematics _____
3. Not adequately prepared to teach mathematics _____

TOTAL (should be the same as Q24a) _____

25. a. **How many teachers in your school teach one or more classes of science?** _____

b. **Of these, how many do you consider:**

1. Highly competent to teach science _____
2. Competent to teach science _____
3. Not adequately prepared to teach science _____

TOTAL (should be the same as Q25a) _____

26. a. How many teachers in your school teach one or more classes of social studies/history? _____

b. Of these, how many do you consider:

1. Highly competent to teach social studies/history ..... _____
2. Competent to teach social studies/history ..... _____
3. Not adequately prepared to teach social studies/history ..... _____

TOTAL (should be the same as Q26a) _____

27. Indicate if your school district provides each of the following as an incentive to teachers in shortage areas.

(Circle one on each line.)

		Yes	No	Don't Know
a.	Extended contracts (11-12 months)	1	2	3
b.	Differential salaries	1	2	3
c.	Subsidized retraining for teachers to change to a field specified as a shortage area	1	2	3
d.	Other *(please specify* _____*)*	1	2	3

28. When did you complete this questionnaire? _____ (Month) _____ (Day) _____ (Year)

THANK YOU FOR YOUR COOPERATION!